*trad off : تعني أنك تتنازل عن شيء من
اجل شيء اخر

*اذا بتتنازل عن الجودة رح يقل عندي السعر.

*في بعض الاحيان بكون بدنا نقلل المشروع او نسرعه
مدة

*ما نيجي نقلل وقت المشروع احنا بنعمل عن تقليل بنقلل الcritical activitys

Activity cost theory

*هون بيحكولنا انو كل يوم الو تكلفة .

*بالـ hyperbolic curve ، بنلاحظ انو لل activity كل ما قللنا وقتها بتزيد الكلفة.

*عشان نقدر نستخدم هذا الكيرف رح نحوله لـ Liner ، عشان يسهل علينا حساب slop = $\frac{\Delta C}{\Delta T}$ = ميت
وهذا

* الان ما بدي أعبي الجداول ما اتحرك من $C_4 \rightarrow C_4$ = وتكون هي

والكل نفس الشي

Ex:

تابع لرسمة باخر صفحة بالبلا يدات (time and cost tradeoff)

From \ To	C 4	Pt1 5	Pt2 7	N 9	
C 4	0	-1600	-966.7	-670	
Pt1 5	1600	0	-650	-437.5	
Pt2 7	966.7	650	0	-225	
N 9	670	437.5	225	0	

* عنا ن نتحرك من نقط $Pt1_{(5)}$ ← $C_{(4)}$ بنحسب الـ SLOPE :

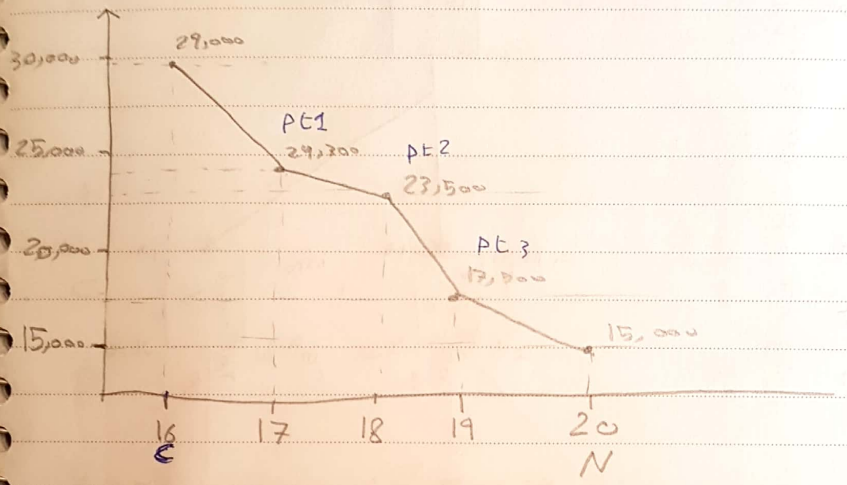
$$\frac{\Delta C}{\Delta t} = \frac{15{,}600 - 14{,}000}{|4 - 5|} = \$1600/day$$

From $Pt2_{(7)}$ ⟶ $C_{(4)}$

$$\frac{\Delta C}{\Delta T} = \frac{15{,}600 - 12{,}700}{|4 - 7|} = \$966.7/day$$

* والباقي نفس الشي

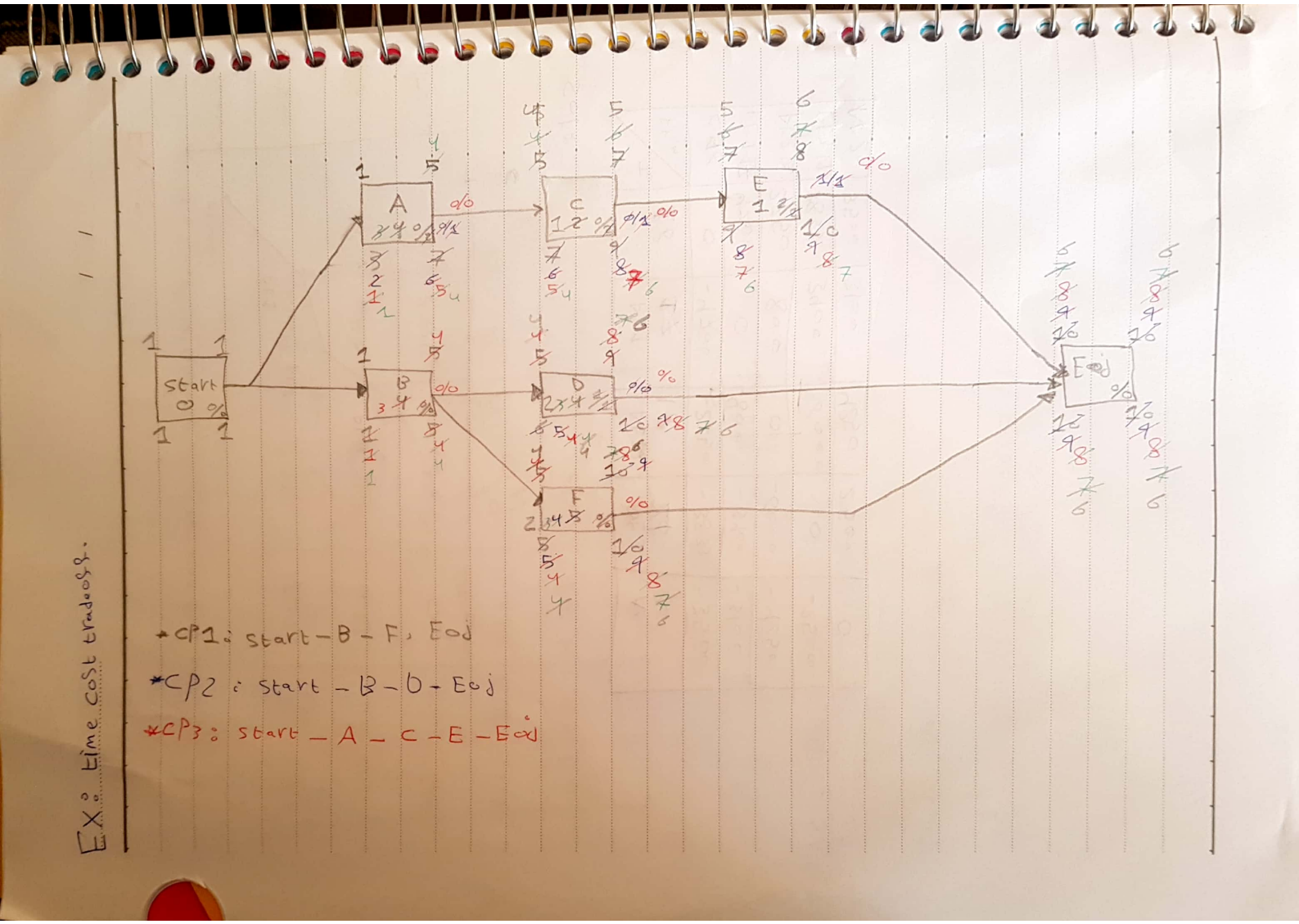
Ex2:



Sol:

From \ To	C	Pt1	Pt2	Pt3	N
	16	17	18	19	20
C 16	0	-4700	-2750	-3833	-3500
Pt1 17	4700	0	-800	-3400	-3100
Pt2 18	2750	800	0	-6000	-4250
Pt3 19	3833	3400	6000	0	-2500
N 20	3500	3100	4250	2500	0

Ex: time cost tradeoff.



*CP1: start - B - F, Eoj

*CP2 : start - B - D - Eoj

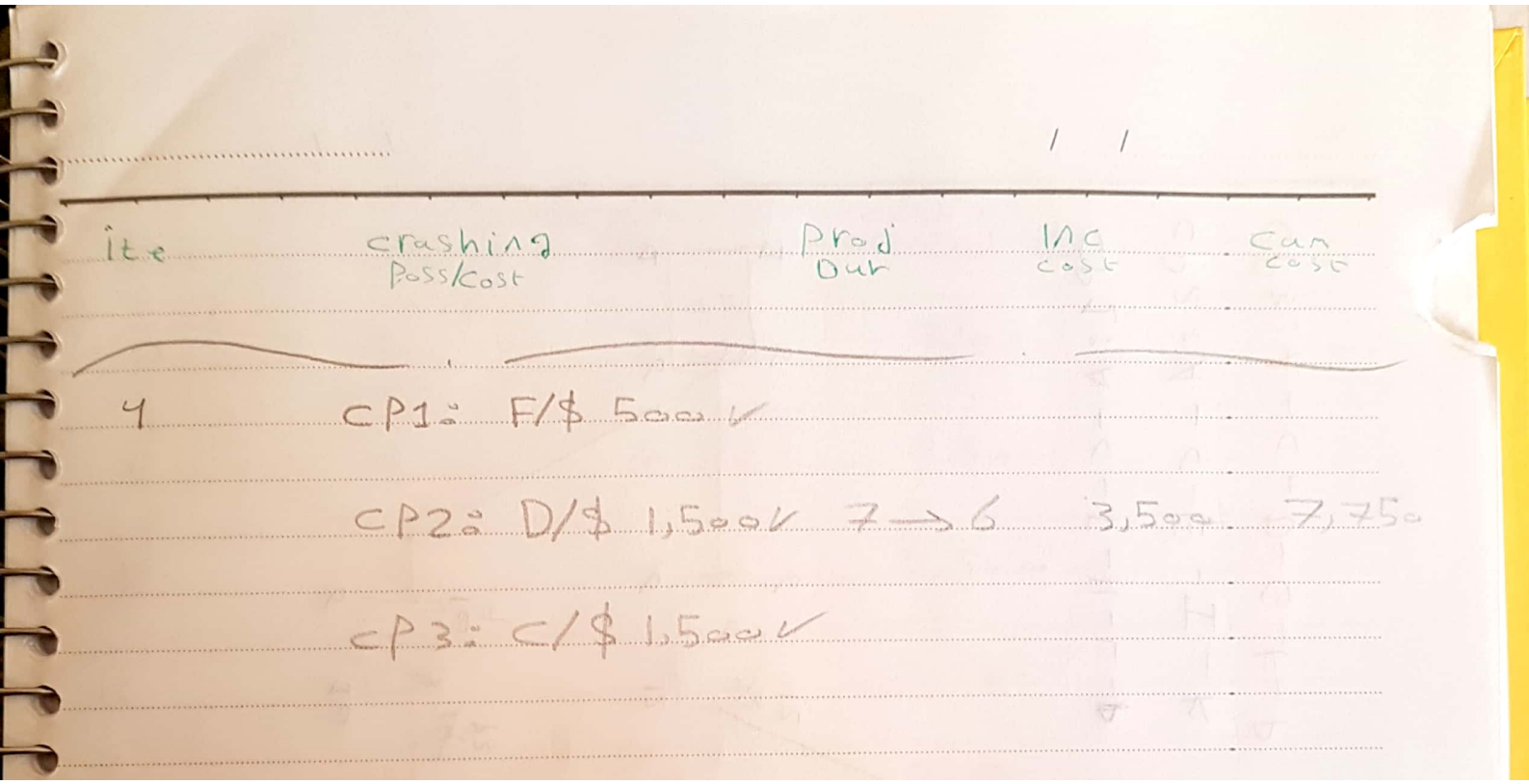
*CP3 : start - A - C - E - Eoj

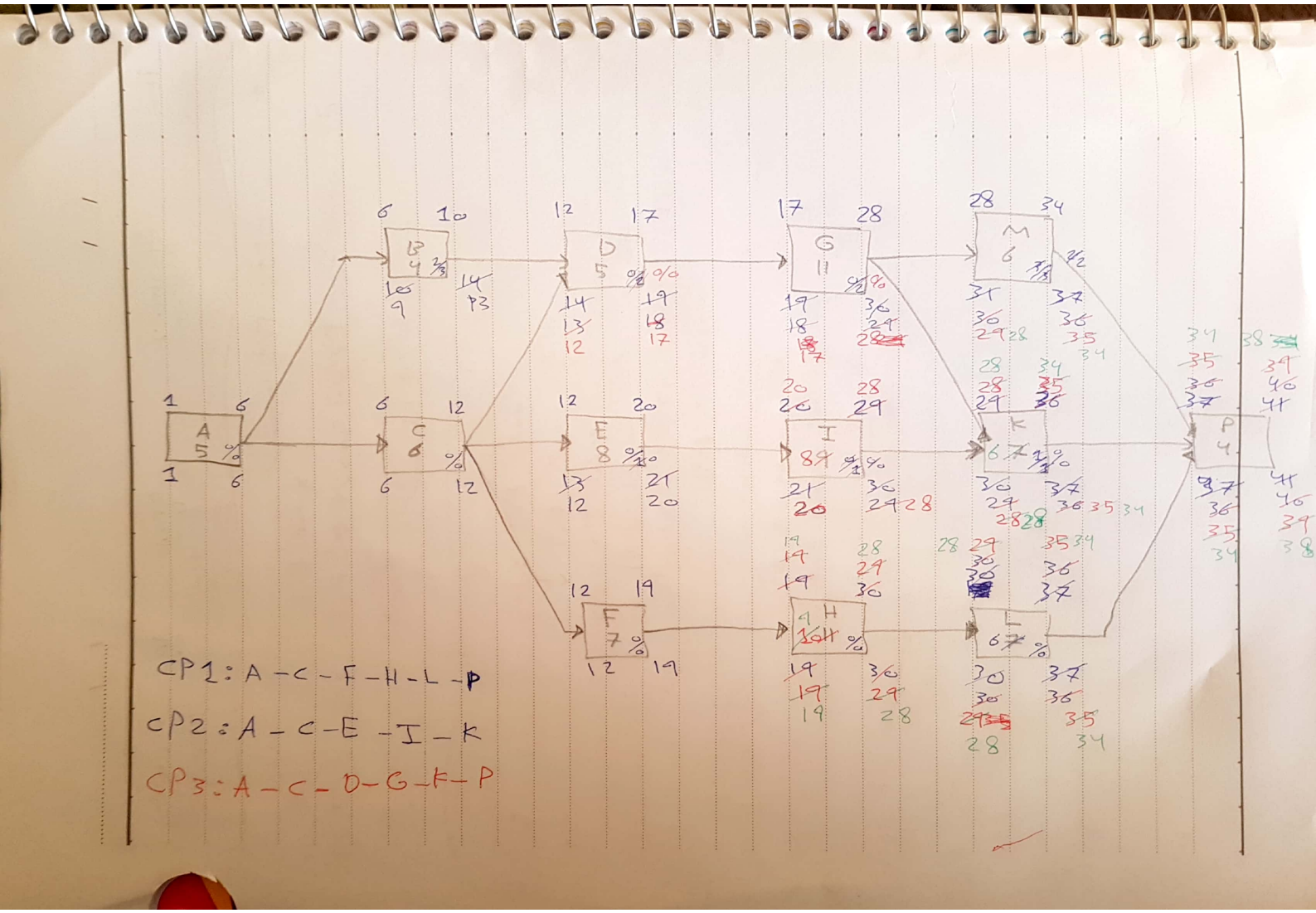
Act	Normal Dur	Exp Dur	Exp cost Per day
A	4	3	250
B	4	3	1,500
C	2	1	1,500
D	4	1	1,500
F	5	2	500

Q) crash the net work from it's normal to it's crashed duration

Iteration	Crashing pass / cost	Proj Dur	Inc cost	Cum cost
1	B/$ 1,500 X F/$ 500 ✓ ✓ لشرائها لانها اقل كلفة	10→9	500	500
2	cp1 : B/$ 1,500 X F/$ 500 cp2 : B/$ 1,500 X D/$ 1,500 or joint cp_1 & cp_2 B/$ 1,500 ✓	9→8	1500	2000
3	cp1 : F/$ 500 ✓ cp2 : D/$ 1,500 ✓ cp3 : A/$ 250 ✓ or C/$ 1,500 X	8→7	2250	4250

* احنا رح نوفر يوم من كل cp
2000$ بطلع مجموعة
ف يوخذ الاقل عشان اوفر





Act	Dur	Crashed Dur	cost of Crash Per day
D	5	4	3,100
E	8	7	2,900
F	7	6	2,500
G	11	8	3,200
H	11	9	2,500
I	9	6	2,900
K	7	6	5,900
L	7	6	2,300

Q) Based on the shown information crash the project by 3 days.

Sol:

Iter	crashing Poss/cost	proj Dur	Inc cost	cum cost
1	F/$ 2,500 X H/$ 2,500 X L/$ 2,300 ✓	41→40	2,300	2,300
2	cp1: F/$ 2,500 X H/$ 2,500 ✓ cp2: E/$ 2900 X I/$ 2,900 ✓ K/$ 5,900	40→39	2500 2900	7,700
3	cp1: F/$ 2,500 X H/$ 2,500 ✓ cp2: E/$ 2,900 X I/$ 2,900 ✓ cp3: D/$ 3,100 ✓ G/$ 3200 X joint cp2 & cp3 K/$ 5,900 → 5,900	anyone $6000	2,500	K,100

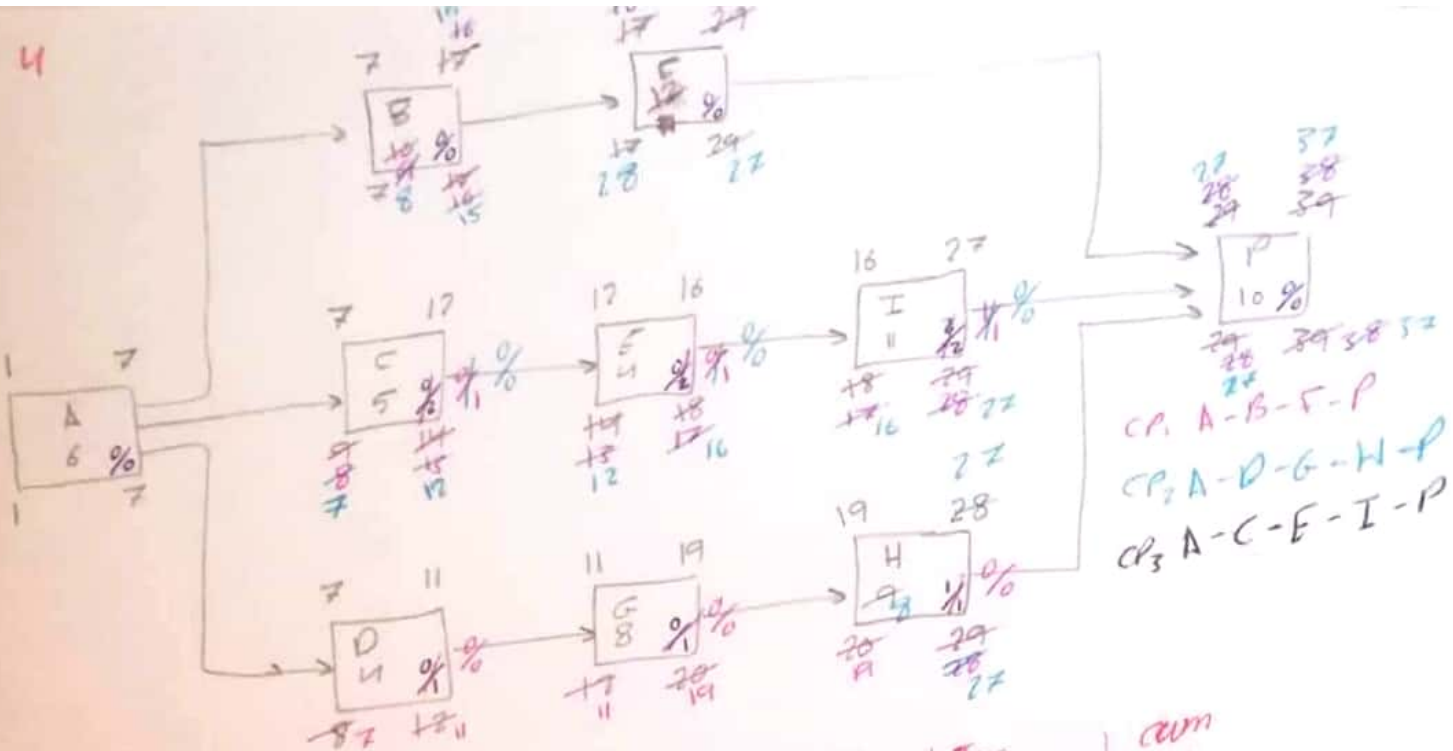
/ /

ملاحظات عن السؤال السابق :

١- اذا تساو التكلفة يوخذ الي بقدر انزلة أيام أكثر .

٢- اشترينا الشاحنة بال (3it) لانو كلفتها ($5,900) وهي اقل من (I, D) اي بتطلع كلفتهم ($6000)

ex 4

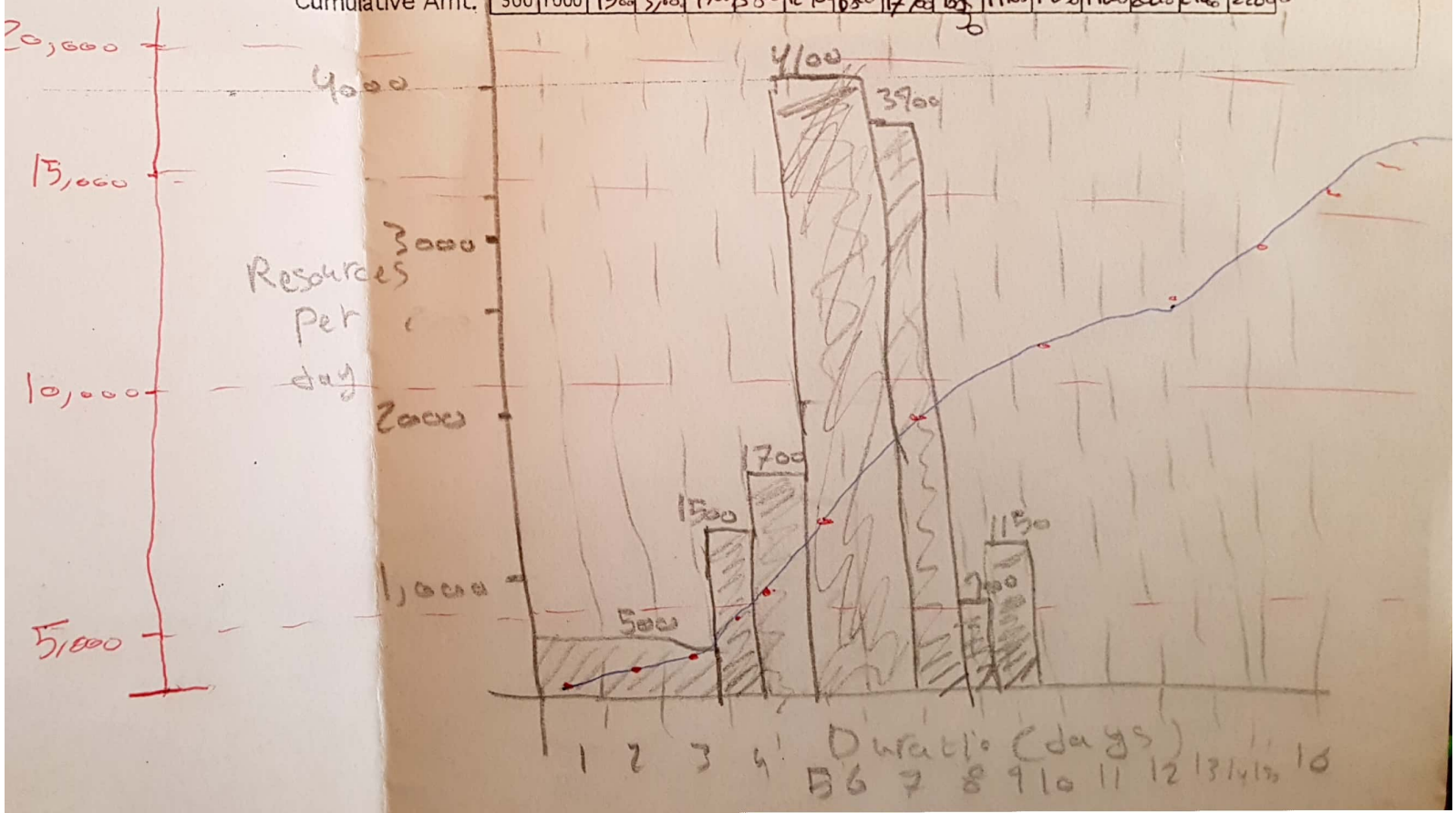


Act	Dur	crash Dur	cost of crash/day
B	10	8	1800
D	4	2	2500
E	4	1	3100
F	12	11	1900
G	8	5	2500
H	9	8	2000
I	11	9	3100

Iter	Crash Pass/Fail	Proj Dur	Inc. Cost	Cum Cost
1	CP① B/$ 1800 ✓ E/$ 1900 X	39 → 38	1800	1800
2	CP① B/$ 1800 ✓ E/$ 1900 X CP② D/$ 2500 X G/$ 2500 X H/$ 2000 ✓	38 → 37	1800 → 3800 2000	5600
3	CP① E/$ 1900 ✓ CP② D/$ 2500 X G/$ 2500 ✓ CP③ E/$ 3100 X I/$ 3100 ✓	37 → 36	1900 2500 → 7500 3100	13100

Question 3 Bar Chart
Use the data below to construct a Resource histogram and s-curve.

Activity	Dur (Days)	Total Resource	Workdays 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Move to Site	4	2,000																
Clear Site	5	5,000																
Survey Site	3	600																
Grade Site	6	3,000																
Exc. for Sewer	3	6,000																
Exc. for Electric	5	2,000																
Install Sewer	4	1,000																
Install Electric	3	3,000																
	Total	22,600																
Period Amount			500	500	500	1500	1700	4100	4100	3900	900	1150	250	250	250	1000	1000	1000
Cumulative Amt.			500	1000	1500	3000	4700	8800	12900	16800	17700	18850	19100	19350	19600	20600	21600	22600



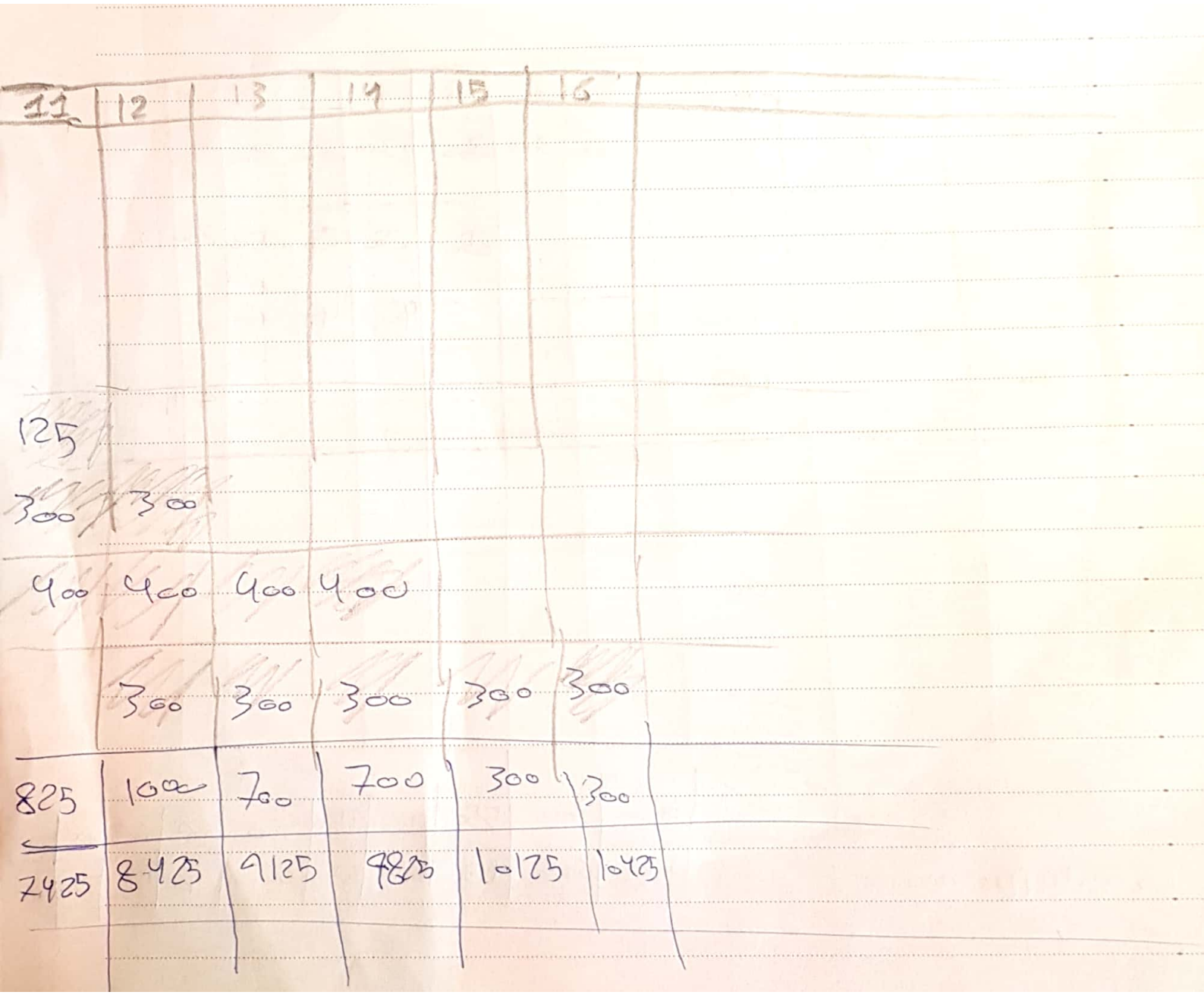
/ /

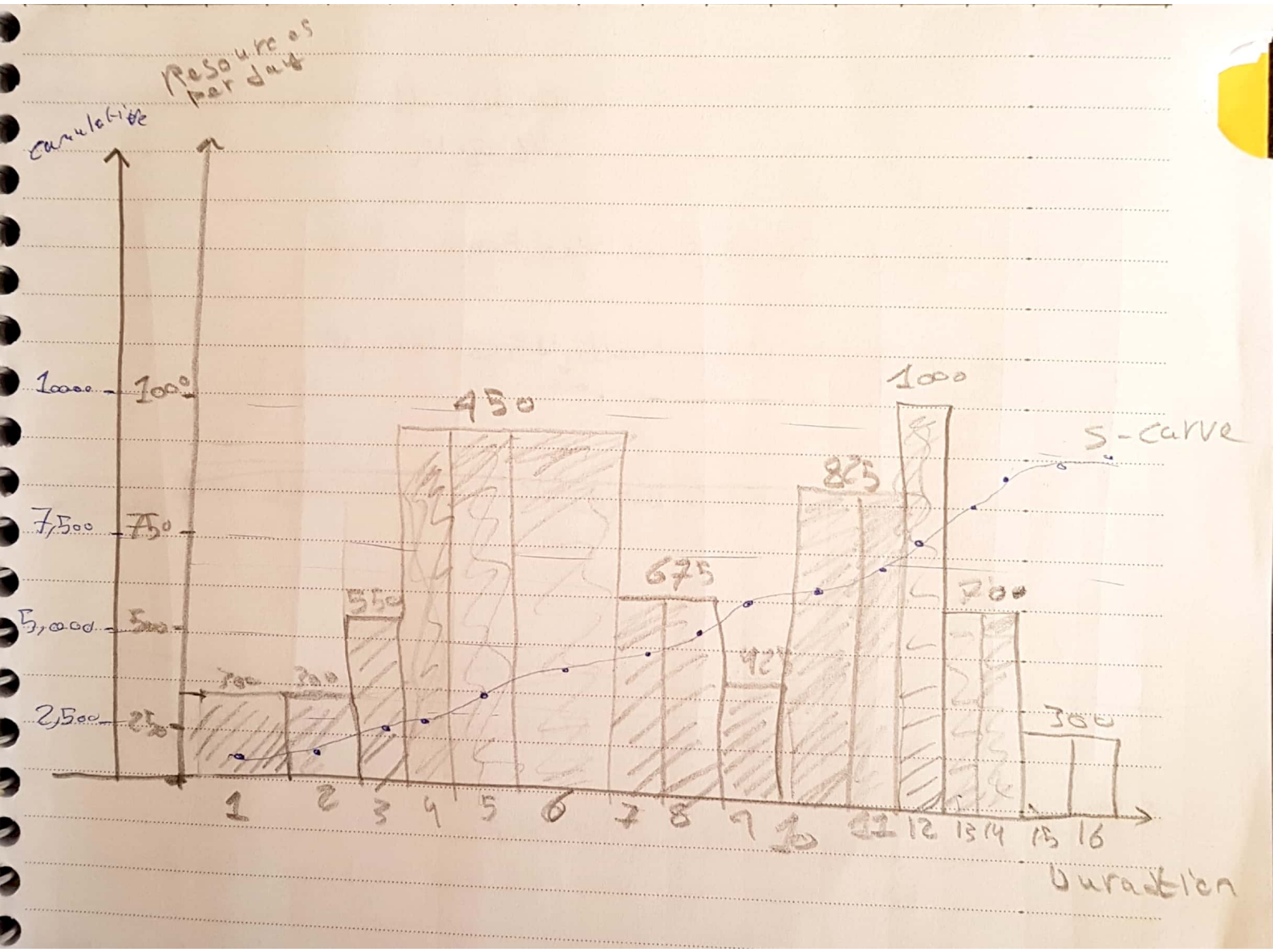
* Histograms and S-curves

*

prob 8 (من الكتاب)

ID	Activity	Duration	Resources per day	1	2	3	4	5	6	7	8	9	10
10	A	7	300	300	300	300	300	300	300	300			
20	B	6	250			250	250	250	250	250	250		
30	C	3	400				400	400	400				
60	D	5	125							125	125	125	125
40	E	5	300								300	300	300
50	F	5	400										400
70	G	5	300										
Period amount				300	300	550	950	950	950	675	675	425	825
Cumulative amount				300	600	1150	2100	3050	4000	4675	5350	5775	6600





In-Class Resource Leveling Example

Minimum Moment Algorithm Approach

Activities are arranged according to their early start

Free float is indicated by -

Number of resources are shown in the table

Note that G depends on C&D

Cycle 0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		C 4	C 4	-	-	-	-	F 4	-	-	-	-	-	-			
	A 1	B 6	B 6	E 3	E 3	E 3	E 3	G 5	G 5	G 5	I 1	I 1	J 3	J 3	K 4	K 4	L 2
		D 3	-	-	-	-	-	H 3	H 3	-	-	-	-	-	-	-	
Resource Sum	1	13	10	3	3	3	3	12	8	5	1	1	3	3	4	4	2

cycle 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		C 4	C 4	—	—	—	—	F 4	—	—	—	—	—	—			
	A 1	B 6	B 6	E 3	E 3	E 3	E 3	G 5	G 5	G 5	I 1	I 1	J 3	J 3	K 4	K 4	L 2
		D 3	-	-	-	-	-	H 3	H 3	-	-	-	-	-	-	-	
Resource Sum	1	13	10	3	3	3	3	12	8	5	1	1	3	3	4	4	2

cycle 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		C 4	C 4	—	—	—	—	F 4	—	—	—	—	—	—			
	A 1	B 6	B 6	E 3	E 3	E 3	E 3	G 5	G 5	G 5	I 1	I 1	J 3	J 3	K 4	K 4	L 2
		D 3	-	-	-	-	-	H 3	H 3	-	-	-	-	-	-	-	
Resource Sum	1	13	10	3	3	3	3	5	5	5	4	4	3	2	4	4	2

cycle 3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		C 4	C 4														
	A 1	B 6	B 6	E 3	E 3	E 3	E 3	G 5	G 5	G 5	I 1	I 1	J 3	J 3	K 4	K 4	L 2
		D 3	-	-	-	-	-	H 3	H 3	-	-	-	-	-	-	-	
Resource Sum	1	9	6	3	3	3	3	5	5	5	4	4	3	3	4	4	2

cycle 4

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
					C 4	C 4							F 4			
A 1	B 6	B 6	E 3	E 3	E 3	E 3	G 5	G 5	G 5	I 1	I 1	J 3	J 3	K 4	K 4	L 2
				D 3	—	—				H 3	H 3	—	—	—	—	

Resource Sum

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	6	6	3	3	7	7	5	5	5	4	4	3	7	4	4	2

cycle 5

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
					C 4	C 4							F 4			
A 1	B 6	B 6	E 3	E 3	E 3	E 3	G 5	G 5	G 5	I 1	I 1	J 3	J 3	K 4	K 4	L 2
			D 3	—	—	—				H 3	H 3	—	—	—	—	

Resource Sum

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	6	6	3	3	7	7	5	5	5	4	4	3	7	4	4	2

cycle 6

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
					C 4	C 4						F 4	—			
A 1	B 6	B 6	E 3	E 3	E 3	E 3	G 5	G 5	G 5	I 1	I 1	J 3	J 3	K 4	K 4	L 2
~~X~~			D 3	—	—	—				H 3	H 3	—	—	—	—	

Resource Sum

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	6	6	6	3	7	7	5	5	5	4	4	7	3	4	4	2

IF(Activity, # of FF days consumed)

$= R * (R_V - R_S - R * N_T)$

- R: Resource Per day
- R_V: اليوم الأول Resource
- R_S: اليوم الأخير
- N_T: Dur of act
- # of FF days consumed
- min

* Example: على الورقة

Cycle 1

IF(H, 1) = 3x(12 − 5 − 3*1) = 12.

2 = Dur of H days

IF(H, 2) = 3x(20 − 6 − 3*2) = 24.

IF(H, 3) = 3*(20 − 2 − 3*2) = 36

IF(H, 4) = 3*(20 − 4 − 3*2) = 30

IF(H, 5) = 3*(20 − 6 − 3*2) = 24

IF(H, 6) = 3*(20 − 7 − 3*2) = 21

IF(H, 7) = 3*(20 − 8 − 3x2) = 18

* Therefore, move H 3days *

Cycle 2 cal

IS(F,1) = 4*(9 - 5 - 4*1) = 0

IF(F,2) = 4*(9 - 5 - 4*1) = 0

IF(F,3) = 4*(9 - 4 - 4*1) = 4

IF(F,4) = 4*(9 - 4 - 4*1) = 4

IF(F,5) = 4*(9 - 3 - 4*1) = 8

IF(F,6) = 4*(9 - 3 - 4*1) = 8

Therefore, move F 6 days

Cycle 3 cal

IF(C,1) = 4*(13 - 3 - 4*1) = 24

IF(C,2) = 4*(23 - 6 - 4*2) = 36

IF(C,3) = 4*(23 - 6 - 4*2) = 36

IF(C,4) = 4*(23 - 6 - 4*2) = 36

Therefore, move C 4 days

IF(D,1) = 3*(13 - 10 - 3*1) = 0

IF(D,2) = 3*(13 - 3 - 3*1) = 21

IF(D,3) = 3*(13 - 3 - 3*1) = 21

IF(D,4) = 3*(13 - 3 - 3*1) = 21

IF(D,5) = 3*(13 - 3 - 3*1) = 21

/ /

4 cycle 4 cal

Re-consider Act D

IF (D,1) = 3*(9-6-3*1) = 0

IF (D,2) = 3*(9-3-3*1) = 9

IF(D,3) = 3*(9-3-3*1) = 9

IF (D,4) = 3*(9-7-3*1) = -3

IF(D,5) = 3*(9-7-3*1) = -3

Therefore, move D stays

*Back floate calculations

cycle 5 cal

IF (D,1) = 3*(6-3*3*1) = 0

IF(D,2) = 3*(6-6-3*1) = -9

IF(D,3) = 3*(6-6-3*1) = -9

/ /

IF(C,1) = 4*(7+6-4*1) = -12

IF(C,2) = 4*(14-9-4*2) = -12

IF(C,3) = 4*(14-9-4*2) = -12

IF(C,4) = 4*(14-12-4*2) = -24

~~IF~~

Therefore, move D back 1 day

Cycle 6 calc

IF(F,1) = 4*(7-3-4*1) = 0

IF(F,2) = 4*(7-4-4*1) = -4

IF(F,3) = 4*(7-4-4*1) = -4

IF(F,4) = 4*(7-5-4*1) = -8

IF(F,5) = 4*(7-5*4*1) = -8

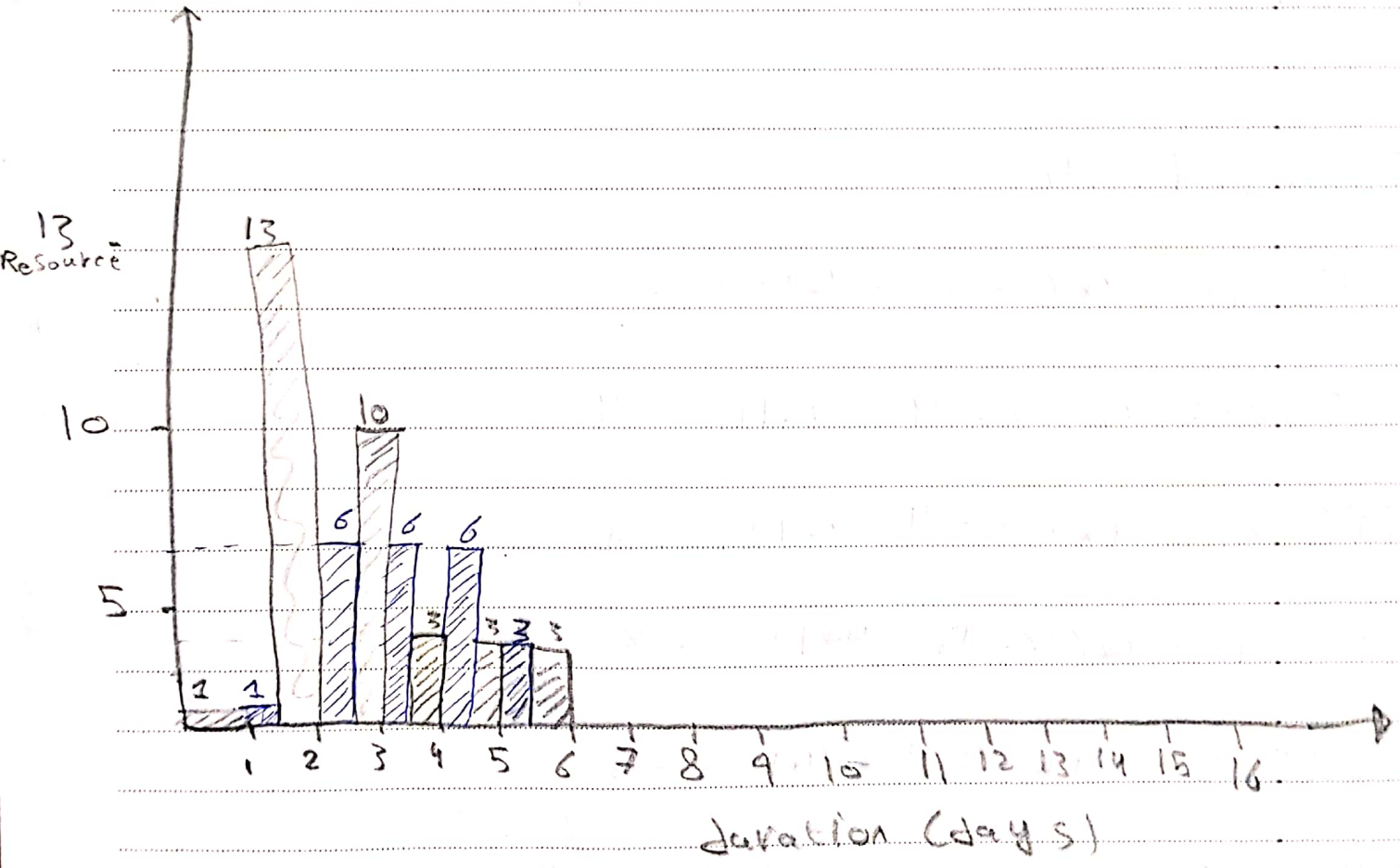
IF(F,6) = 4*(7-5-4*1) = -8

IF(H,1) = 3*(4 - 5 - 3*1) = -12

IF(H,2) = 3*(8 - 10 - 3*2) = -24

IF(H,3) = 3*(8 - 10 - 3*2) = -24

Therefor move F back 1 day



cycle 6

cycle 5

Example 1 - Resource leveling based on Minimum Moment Algorithm approach

Activities are arranged according to their early start

Free float is indicated by -

Cycle 0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
			C 6	C 6	C 6	-	-	P 12	-	-	-	-		
	A 5	A 5	B 9	B 9	B 9	B 9	B 9	E 10	E 10	E 10	E 10	E 10	H 8	H 8
			D 5	D 5	-	-	-	M 4	M 4	-	-	-		
∑Res.	5	5	20	20	15	9	9	26	14	10	10	10	8	8

Cycle 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
			C 6	C 6	C 6	—	—	----	----	----	----	P 12		
	A 5	A 5	B 9	B 9	B 9	B 9	B 9	E 10	E 10	E 10	E 10	E 10	H 8	H 8
			D 5	D 5	—	—	—	M 4	M 4	—	—	—		
∑Res.	5	5	20	20	15	9	9	14	14	10	10	22	8	8

Cycle 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
			C 6	C 6	C 6	—	—	----	----	----	----	P 12		
	A 5	A 5	B 9	B 9	B 9	B 9	B 9	E 10	E 10	E 10	E 10	E 10	H 8	H 8
			D 5	D 5	—	—	—	----	----	M 4	M 4	—		
∑Res.	5	5	20	20	15	9	9	10	10	14	14	22	8	8

Cycle 3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
			----	----	C 6	C 6	C 6	----	----	----	----	P 12		
	A 5	A 5	B 9	B 9	B 9	B 9	B 9	E 10	E 10	E 10	E 10	E 10	H 8	H 8
			D 5	D 5	—	—	—	----	----	M 4	M 4	—		
∑Res.	5	5	14	14	15	15	15	10	10	14	14	22	8	8

Cycle 4	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	A 5	A 5	B 9	B 9	B 9	B 9	B 9	E 10	E 10	E 10	E 10	E 10	H 8	H 8
∑Res.														

Cycle 5	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	A 5	A 5	B 9	B 9	B 9	B 9	B 9	E 10	E 10	E 10	E 10	E 10	H 8	H 8
∑Res.														

1) cycle 1 calculations:

If(P,1) = 12*(26-14-12*1) = 0
If(P,2) = 12*(26-10-12*1) = 48
If(P,3) = 12*(26-10-12*1) = 48
If(P,4) = 12*(26-10-12*1) = 48

If(M,1) = 4*(26-10-4*1) = 48
If(M,2) = 4*(40-20-4*2) = 48
If(M,3) = 4*(40-20-4*2) = 48

There for, move P 4 days

2) cycle 2 calculations: (reconsider M):

If(M,1) = 4(14-10-4*1) = 0
If(M,2) = 4(28-20-4*2) = 0
If(M,3) = 4(28-32-4*2) = -48
There fore, move M 2 days.

3) cycle 3 calculations:

If(C,1) = 6(20-9-6*1) = 30
If(C,2) = 6(40-18-6*2) = 60
If(D,1) = 5(20-15-5*1) = 0
If(D,2) = 5(40-24-5*2) = 30
If(D,3) = 5(40-18-5*2) = 60
C → has more resource per day.
There fore, move C 2 days.

4) cycle 4 Calculations:

Re-consider D
If(D,1) = 5(14-15-5*1) = -30
If(D,2) = 5(28-30-5*2) = -60
If(D,3) = 5(28-30-5*2) = -60
There for, don't move D

* Backtrack consideration:

IF(C,1) = 6(15-14-6*1) = -30
If(C,2) = 6(30-28-6*2) = -60
Therefore, Don't Move C
((still calculating for cycle 4...))

- Locate the critical paths

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Hashemite University

Construction Planning & Scheduling
Dr. Mohammad S. El-Mashaleh

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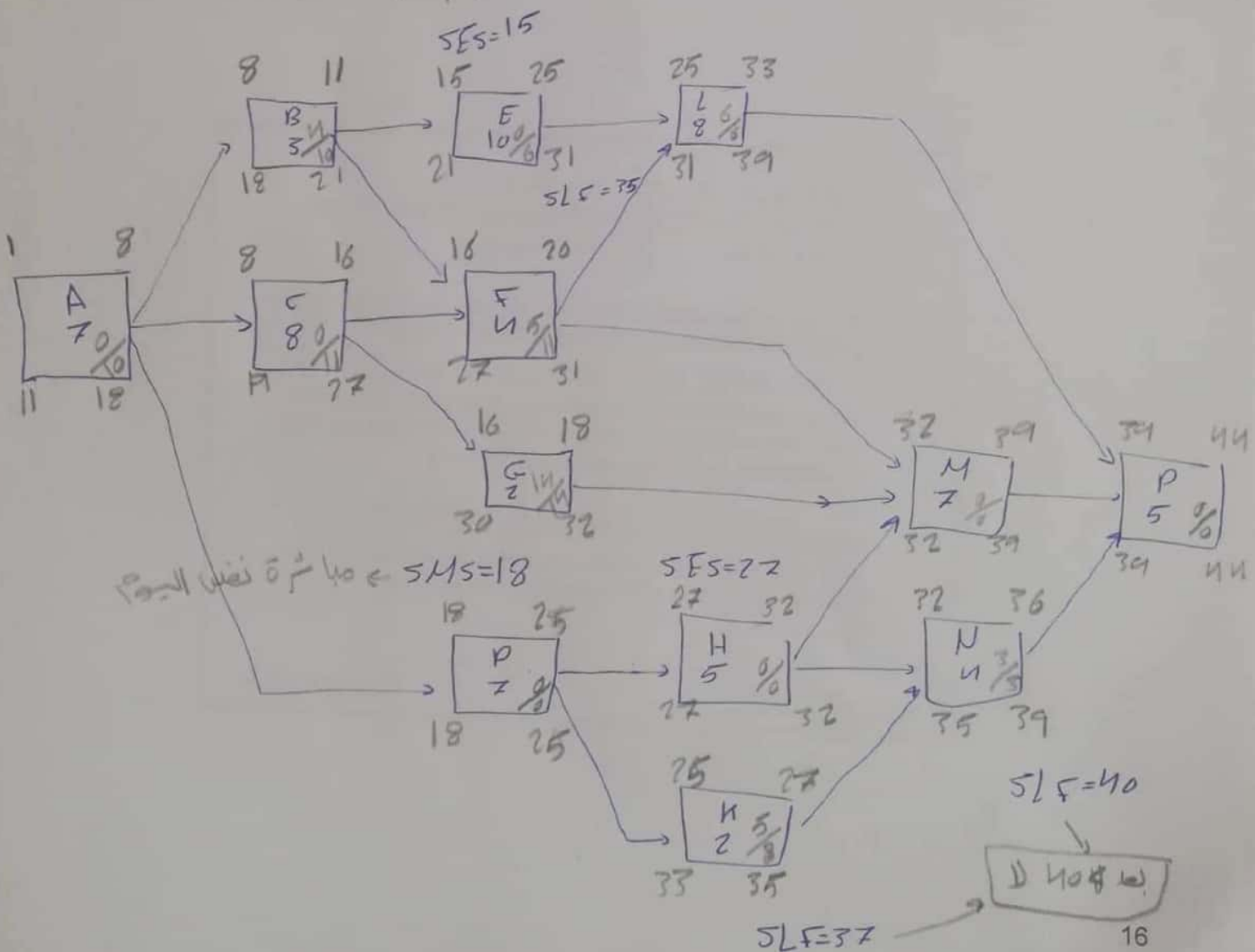
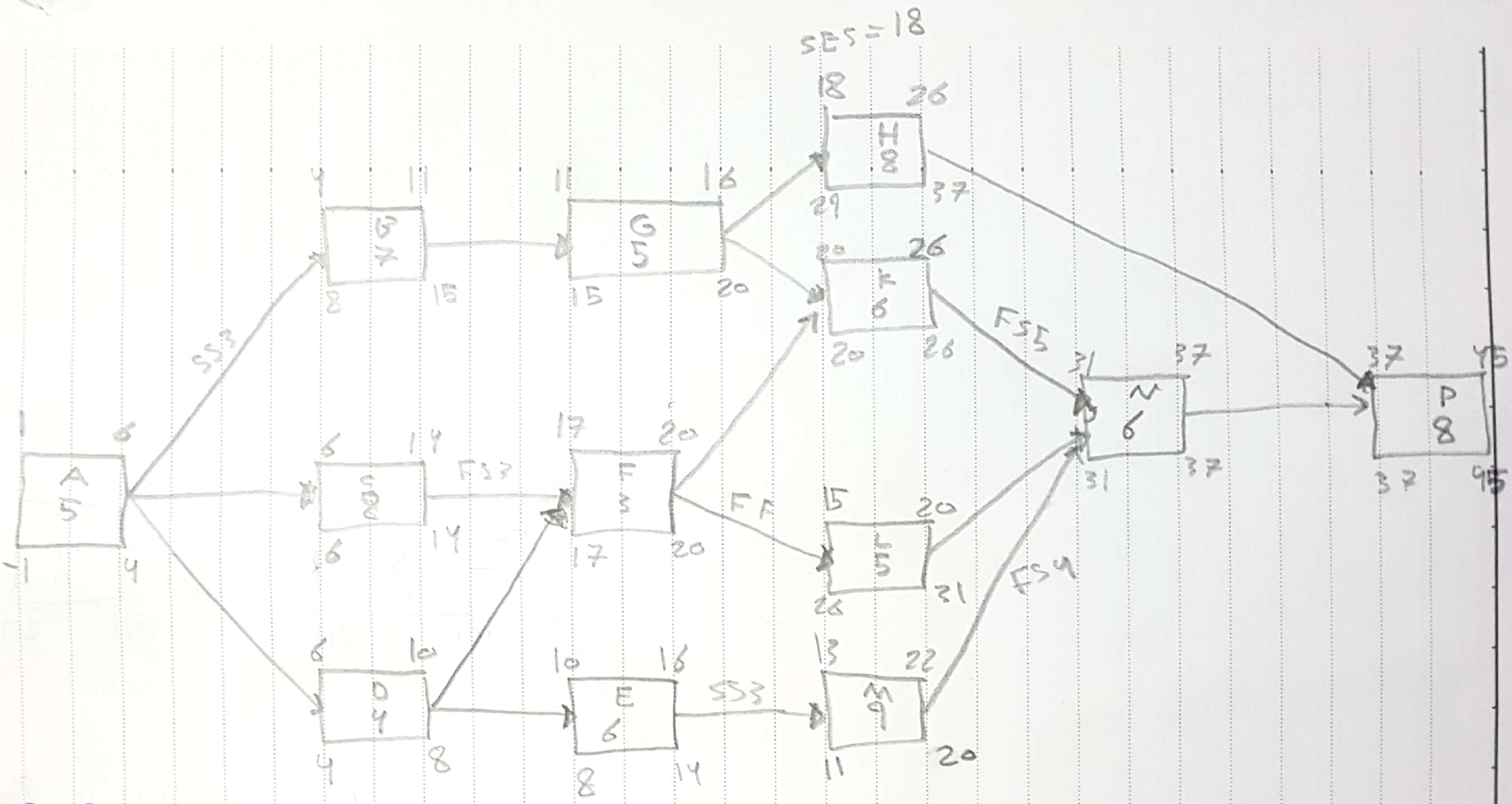
ex1

لا تبدأ قبل يوم 15





P = 0/0
N = 0/0
H = 9/9
K = 5/0
L = 11/11
M = 9/2

F = 0/0
G = 9/4
F = 5/0
E = 3/2
B = 0/4
C = 3/0

D = 7/2
A = 4/2
A = 2/2

SLF$_M$ = 20

P = 0/0
N = 0/0
H = 11/11

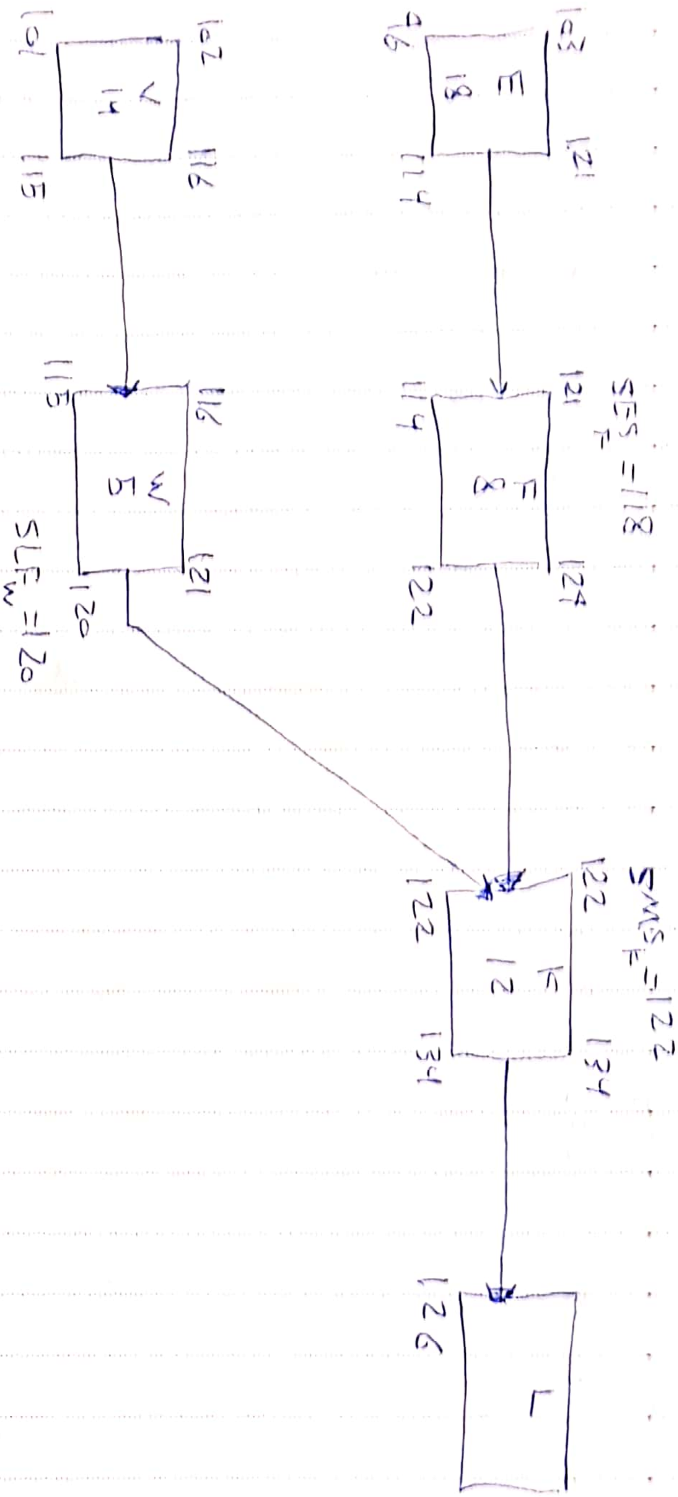
K = 0/0
L = 11/11
M = 5/-2

G = 2/4
F = 0/0
E = 0/-2

B = 0/4
C = 0/0
D = 0/-2

A = 0/-2

Ex 2:



جدولة earned Value (EV)

* Earned Value : هي القيمة المكتسبة

*اول من تعامل بال (EV) هي وزارة الدفاع الامريكية عشان تحسن من مشاريعها.

*Department of Defense (DoD):

*يستخدم (EV) عشان اعرف حد التقدم المنجز في العمل ومقارنة العمل المخطط له مع العمل الفعلي المنجز

* تستخدم الـ EV لحساب:

١- حساب النسبة المئوية الكاملة للمشروع.

٢- أداء التكلفة

٣- اداء الجدول

* بال EV بستخدم عدة أمور للحصول على الصورة الحالية للمشروع:

1- BCWS : Budgeted cost of work scheduled (Planned)
* يعني حسب شو كنت مخطط

2- BCWP : Budgeted cost of work performed (Earned)
تنفذ — حصل

3- ACWP : Actual cost of work Performed (Actual)

4- BAC : Budgeted cost At completion. ← قديش كنت متوقع يكلفني والانتهاء من المشروع

5- EAC : Estimated cost At completion. ← بعد مرور اشهر بحسب من بداية المشروع قديش دفعت

*- اي شي Budgeted يعني حسب planned

في نهاية المشروع كم

حل بحسبهم عند اليوم ال 6 مثلا

Planned

* BCWS = Budgeted cost of work scheduled
تكلفة العمل المدرجة في الميزانية

*هذا يكون على اساس التخطيط الي صار للمشروع.

* BCWS : هو مقدار المال أوساعات العمل ، التي تم التخطيط لها. BCWS

Actual

*ACWP = Actual cost of work perfomed

*هو المبلغ الفعلي للأموال (أوساعات العمل) التي تم إنفاقها في أي وقت خلال المشروع

*تتغير عندما تم دفعة

Earned
تحصل

* BCWP = Budgeted cost of work Performed

*This is the Earned Valve

* BCWP : هو مقدار المال اوساعات العمل المكتسبة بناءً على العمل الذي تم انجازة

1* cost performance : (اداء التكلفة) → هل تعدينا الميزانية اولا تحت
- cost varince (CV) (فروق التكلفة)
- cost performance index (CPI) ( ) مؤشر اداء التكلفة

2* Schedule performance → تحت الخطة وله تعيناها بالوقت
// Variance (SV)
// performance index (SPI)

CV و CPI

* CV = BCWP − ACWP (Earned − Actual)

* CPI = BCWP / ACWP Earned / Actual

* ACWP > BCWP → over budges

CPI > 1 → under Budget ، CV + → under Budget

SV و SPI

* Calc % complete

% complete = [BCWP / BAC] * 100 %

* SV = BCWP − BCWS

* SPI = BCWP / BCWS Earned / planed

+ SV, SPI > 1 → ahead of scedule

*

Forecasting (التوقع)

EAC = ACWP + (BAC − BCWP)

* BAC = Budgeted cost At completion

هالتقدير التكلفة الاصلي التكلفة الاجمالي للبناء .

* EAC = Estimated cost At completion

هذا توقعات الكلفة الكلية حسب اداء المشروع الى الان

ex:

Activity	cost $	Month 1	M 2	M 3	M 4	M 5	M 6
site work	22,000	#					
Fencing	10,000		#				
paving	18,000			#			
Excavation	30,000		#				
Foundation	50,000			#			
Framing	110,000				#		
Rough Elec.	6,000				#		
Rough Plump	16,000				#		
Drywall	13,000					#	
suspend ceiling	4,000					#	
Interior Finish	34,000						#
Carpenting	14,000						#
Σ	257,000						

- After $3\frac{1}{2}$ Months

- The site work, excavation, Foundation Fencing and rough electrical are completed
- The Framing is one half - complete
- The rough plumping is three - Fourths complete
- The paving is half complete.
- The incurred cost to date are $ 152,000

- Determin % complete, CPI & SPI ?
- is the project under lover budget ?
- is the project ahead/behind schedule ?
- Estimate the cost at comp

$ACWP = \$\ 152{,}000$

$BCWP$ = Site Work + excavation + Foundation + Fencing + Rough Electrical $+\frac{1}{2}\frac{\text{Framing}}{2}$ + $\frac{3}{4}$ Rough plumping + $\frac{1}{2}$ paving

$= 22{,}000 + 30{,}000 + 50{,}000 + 10{,}000 + 6{,}000 + \frac{1}{2} * 40{,}000 + \frac{3}{4} * 16{,}000 + \frac{1}{2}\ 18{,}000$

$= \$\ 159{,}000$

$BCWS$ = Site Work + Fencing + Paving + Excavation + Foundation $+\frac{1}{2}\left(\text{Framing} + \frac{\text{Rough}}{\text{Elec}} + \frac{\text{Rough}}{\text{plump}}\right)$

$= 22{,}000 + 10{,}000 + 18{,}000 + 30{,}000 + 50{,}000 + \frac{1}{2}(40{,}000 + 6{,}000 + 16{,}000)$

$= \$\ 161{,}000$

① $\%\ comp. = \frac{BCWP}{BAC} * 100\% = \frac{159{,}000}{257{,}000} * 100\% = 61.9\%$

② $CPI = \frac{BCWP}{ACWP} = \frac{159{,}000}{152{,}000} \simeq$

$\simeq 1.05 > 1$ (under budget)

③ $SPI = \frac{BCWP}{BCWS} = \frac{159{,}000}{161{,}000}$

$\simeq 0.aa < 1$

behind schedule

$BAC = \$\ 257{,}000$

$EAC = ACWP + (BAC - BCWP)$

$= 152{,}000 + (257{,}000 - 159{,}000)$

$= \$\ 250{,}000$

8. The following eight activities constitute an overall bar chart portrayal of a four-month project.

Activity	Cost	Month 1	Month 2	Month 3	Month 4
A	$ 2,000				
B	$ 1,000				
C	$ 6,000				
D	$ 2,000				
E	$ 7,000				
F	$ 9,000				
G	$ 3,000				
H	$10,000				

After one and one-half months, Activities A, B, D, and half of E were completed, for a cost of $8,000. For this project, using earned value concepts, determine the schedule variance and the cost variance. State if the project is over or under budget and if it is ahead or behind schedule.

11.11

Q8

* ACWP = $8,000

* BCWS = $A + B + \frac{C}{2} + \frac{D}{2} + \frac{E}{4}$

$= 2,000 + 1,000 + \frac{1}{2}\,6000 + \frac{1}{2}\,2000$

$+ \frac{1}{4} * 7,000 = \$8,750$

$BCWP = A + B + D + \frac{1}{2} E$

$= 2,000 + 1,000 + 2,000 + \frac{1}{2} * 2,000 = \$8$

$SV = BCWP - BCWS$

$= 8,500 - 8,750 = -250$

(behind schedule)
لانها سالب

$C.V = BCWP - ACWP$

$= 8500 - 8000 = +500$ (under budge

7. The following depicts a six-month schedule for a project.

Activity	Cost	April	May	June	July	August	Sept.
A	$ 50						
B	$120						
C	$ 80						
D	$200						
E	$120						
F	$300						
G	$ 60						
H	$ 70						
J	$ 50						
K	$ 60						

After three months on the job (July 1), the contractor concluded that 20% of Activity F (Activities A, B, and D are completed) was completed, 80% of Activity C was completed, and 40% of Activity E was completed. The project has cost the contractor a total of $535. For this project, using earned value concepts, determine the schedule variance and the cost variance. State if the project is over or under budget and if it is ahead or behind schedule.

ACWP = $535

BCWS = A + B + C + D + $\frac{1}{2}$ E + $\frac{1}{2}$

= 50 + 120 + 80 + 200 + 120 + $\frac{1}{2}$ = 510 $

BCWP = 0.2F + A + B + D + 0.8C + 0.4E

= $542

SV = BCWP − BCWS

= 542 − 510 = +32 (ahead of schedule)

CV = BCWP − ACWP

= 542 − 535 = +7 (under budget)

% complete = $\frac{BCWP}{BAC} * 100\%$ = $\frac{542}{1,110} * 100\%$

= 48.82 %

Example 1:

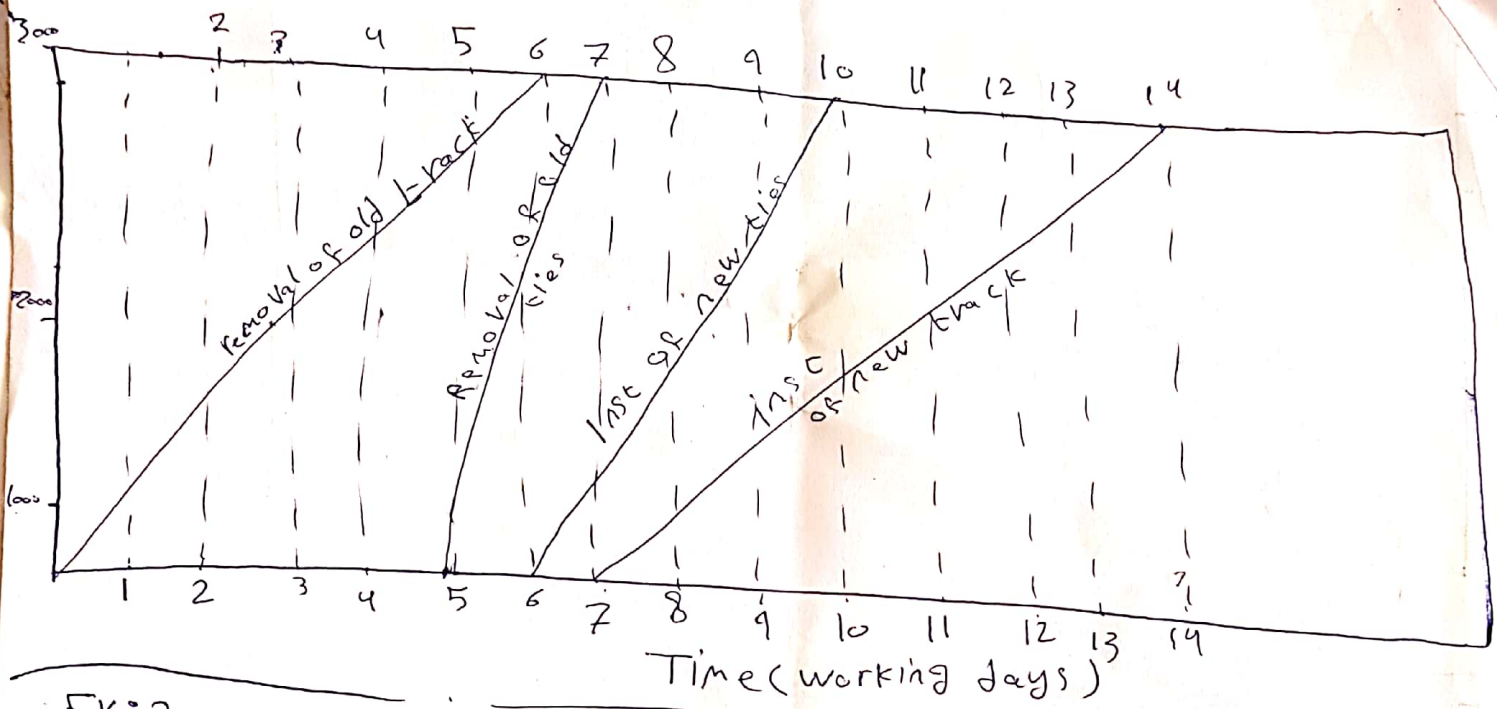
* Develop a linear schedule for a project that consists of replacing the track on an existing railroad line, involving 3,000 ft of track.

* Activities and production rates are shown in the next slide.

* Assume a min of 1-day time buffer between activities

Activity	production rate (ft/hr)	production per day (ft)	Duration for 3000 ft
Removal of old track	62.5	500	6
Removal of old railroad ties	187.5	1500	2
installation of new ties	93.75	750	4
installation of new track	54	432	7

EX: 1



EX: 2

*Develop a linear schedule for the project below

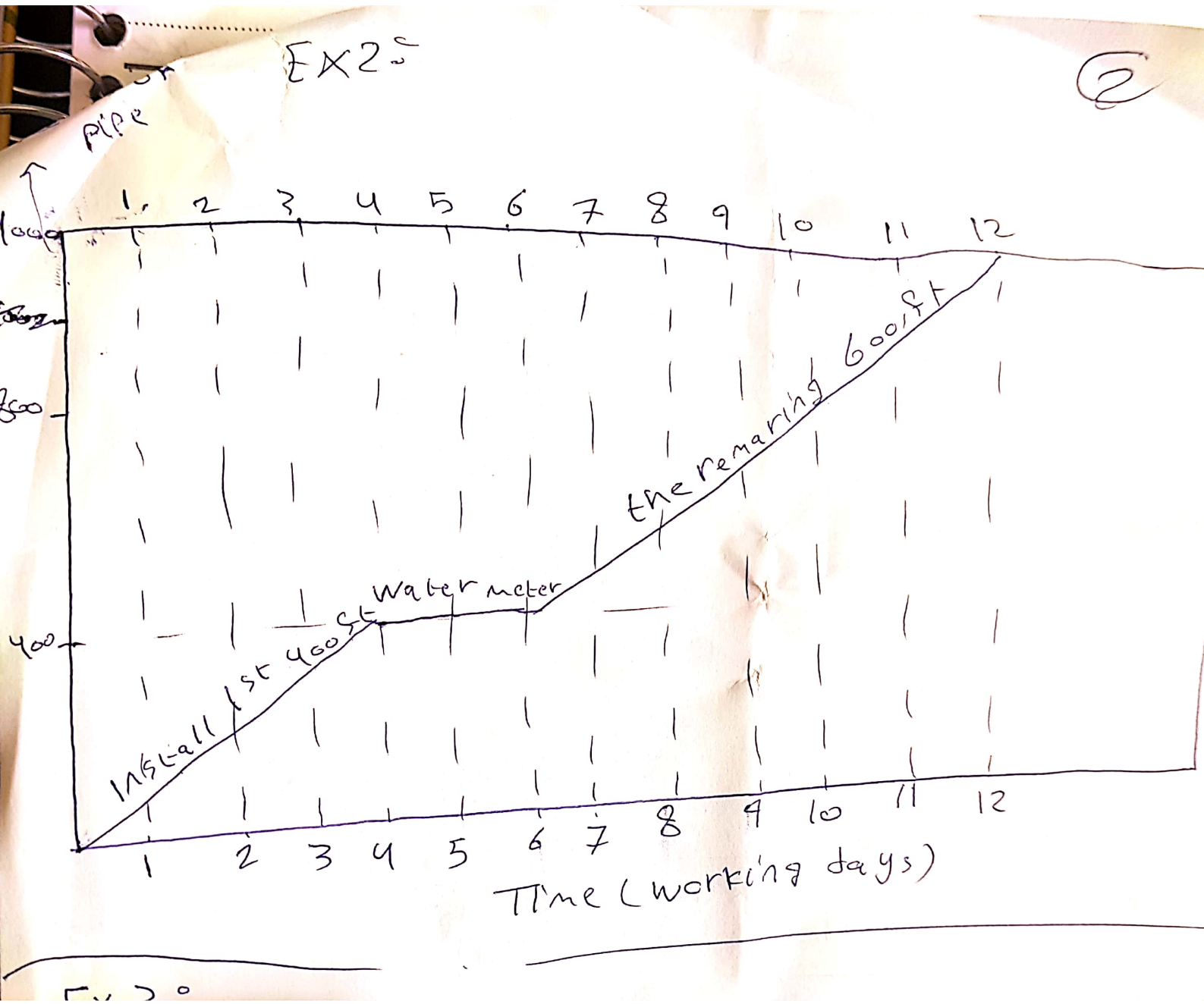
*A shallow trench for, 1000-foot water line installation will take 10 days

*,It will take 4 days to install the first 400 ft of pipe

*A water meter will then be installed during the following 2 days at the end of the pipe.

*After the meter is installed, the remaining 600 ft of pipe will be installed in 6 days.

Ex2:



Ex 2:

Ex 3:

- Develop a linear schedule for a project to replace an old existing walkway
- The walkway is 16,000 ft Long and 4 ft wide it consists of activities shown in the next slide
- Assume a minimum 1- week time buffer between activities

Ex 3

Activity	Description	Production rate (linear ft/wk)	Duration (wk)
A	Demolition and removal of old asphalt pavement	2000	8
B	Level and roll	1000	16
C	Place 3 inch aggregate base	1800	9
D	Pave with asphalt	1800	9
E	Install new signs and markings	5400	3